CLAIMS

1. A method of determining the effective concentration of divalent cations in a fabricated electrolyte, the method comprising

determining the concentration of divalent cations in a fabricated electrolyte;

determining the concentration of trivalent cations in a fabricated electrolyte and subtracting the adjusted concentration of trivalent cations from the concentration of divalent cations to produce the effective concentration of divalent cations.

2. A method according to claim 1, wherein the concentration of divalent cations in a fabricated electrolyte is determined by adding the concentration of divalent cations that were added to the electrolyte prior to completion of a fabrication process to the concentration of divalent cations determined to be in the electrolyte after the fabrication process, had there been no additions.

3. A method according to claim 1 or claim 2, wherein at least some of the divalent cations are produced in the electrolyte by converting or reducing trivalent cations into divalent cations.

4. A method according to claim 3, wherein trivalent cations are converted or reduced into divalent cations during the fabrication process.

5. A method according to claim 4, wherein trivalent cations are converted or reduced into divalent cations during the fabrication process by appropriate control of an oxygen or water partial pressure in a sintering furnace.

6. A method according to any one of the preceding claims, wherein divalent cations are added to the electrolyte prior to completion of the fabrication process.

7. A method according to any one of the preceding claims, wherein at least some of the divalent cations in the electrolyte originate from vapours produced from a metal substrate or an oxide layer on a metal substrate.

8. A method according to any one of the preceding claims, wherein the concentration of cations is controlled such that the effective concentration of divalent cations is arranged to be between 0.01 mole % and 0.1 mole % inclusive.

9. A method according to claim 8, wherein the effective concentration of divalent cations is arranged to be between 0.02 mole % and 0.09 mole % inclusive.

10. A method according to claim 9, wherein the effective concentration of divalent cations is arranged to be between 0.03 mole % and 0.08 mole % inclusive.

11. A method according to any one of the preceding claims, wherein the determined concentration of trivalent cations is adjusted by multiplication typically by a factor between 5 and 10.

12. A method of preparing a ceria based electrolyte with a density greater than 97% of the theoretical achievable density, the method comprising;

providing a ceria based electrolyte and

sintering the electrolyte at 1200°C or less such that the concentration of divalent cations minus the adjusted concentration of trivalent cations in the sintered electrolyte is between 0.01 mole % and 0.1 mole %.

13. A method according to claim 12, wherein the conditions of the sintering process are controlled to reduce at least some trivalent cations in the electrolyte into divalent cations.

14. A method according to claim 13, wherein the conditions of the sintering process are controlled to produce a suitable oxygen or water pressure to reduce a suitable amount of trivalent cations into divalent cations.

15. A method according to claim 12, claim 13 or claim 14, wherein the electrolyte

is provided on a substrate and the substrate material is selected to produce the required concentration of divalent cations minus the adjusted concentration of trivalent cations in the electrolyte.

16. A method according to claim 15, wherein an electrode is provided between the electrolyte and the substrate.

17. A method according to any of claims 12 to 16, wherein divalent cations are added to the electrolyte before or during the sintering process.

18. A method according to any of claims 12 to 17, wherein the concentration of divalent cations minus the adjusted concentration of trivalent cations in the sintered electrolyte is between 0.02 mole % and 0.09 mole % inclusive.

19. A method according to claim 18, wherein the concentration of divalent cations minus the adjusted concentration of trivalent cations in the sintered electrolyte is between 0.03 mole % and 0.08 mole % inclusive.

20. A method according to any of claims 12 to 19, wherein the concentration of trivalent cations is adjusted by multiplication by a number between 5 and 10.

21. A method according to any claims 12 to 20, wherein the electrolyte is sintered at 1100°C or less.

22. A method according to claim 21, wherein the electrolyte is sintered at 1050°C or less.

23. A method according to claim 22, wherein the electrolyte is sintered at 1000°C or less.

24. A method according to any one of claims 12 to 23, wherein the electrolyte is provided as a thick film.

25. A ceria based electrolyte with a density greater than 97% of the theoretical achievable density and with a concentration of divalent cations minus an adjusted concentration of trivalent cations of between 0.01 mole % and 0.1 mole % inclusive.

26. An electrolyte according to claim 25, wherein the concentration of divalent cations minus an adjusted concentration of trivalent cations is between 0.02 mole % and 0.09 mole % inclusive.

27. An electrolyte according to claim 26, wherein the concentration of divalent cations minus an adjusted concentration of trivalent cations is between 0.03 mole % and 0.08 mole % inclusive.

28. An electrolyte according to any of claims 25 to 27, wherein the concentration of trivalent cations is adjusted by multiplication by a number between 5 and 10.

29. An electrolyte according to any claims 25 to 28, wherein the electrolyte is provided as a thick film.

30. A half cell assembly comprising a substrate, an electrode and an electrolyte according to any of claims 25 to 29.

31. A fuel cell assembly comprising a half cell according to claim 30 and a further electrode provided on the opposite side of the electrolyte from the first electrode.

32. A fuel cell according to claim 31, wherein the first electrode is an anode and the further electrode is a cathode.

33. An oxygen generator comprising a half cell assembly according to claim 30 and a further electrode provided on the opposite side of the electrolyte from the first electrode.